19 European Patent Office

12 **EUROPEAN PATENT APPLICATION**

43 Publication date:
06.03.2002 Patent Reports 2002/10

21 Application no.: 01117412.5

22 Application date: 19.07.2001

11 EP 1 184 104 A1

51 Int. Cl.[7]: B22C 9/08

84 Named treaty states:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR
Named extension states:
AL LT LV MK RO SI

30 Priority: 08.08.2000 DE 10039519

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54 **FEEDER SLEEVE**

57 A feeder sleeve is described for use in casting metals in casting moulds, with a cavity for receiving molten metals.

The feeder sleeve according to invention (2) comprises at least two mould elements (4, 6), which can be telescoped in or out along a feeder's longitudinal axis (20) and which laterally surround the cavity for receiving molten metals.

On the first and / or second mould elements retaining elements (12) can be mounted, through which the first mould element carries the second mould element, and which can be separated or deformed in such a way that it is possible to telescope the two mould elements in or out along the feeder sleeve's longitudinal axis (20).

DESCRIPTION

The invention relates primarily to an enclosed feeder sleeve – hereinafter also referred to as "a feeder" – for use in casting metals in casting moulds, with a cavity for receiving molten metals.

During the manufacture of a casting mould, feeder sleeves of this type are integrated into the said mould and form a space, surrounded by moulding material, which has a channel (passage) to the mould cavity, and which is filled with molten metal by the cast flow during casting. The said molten metal is intended to flow back to the casting during the solidification process and compensate for the volume deficit when the casting solidifies. The formation of so-called blowholes (i.e. shrinkage cavities which arise during the solidification process due to the contraction in the metal volume) is prevented in this way.

In order to guarantee a proper feed process, the metal in the feeder must solidify later than the metal of the casting – i.e. the modulus (volume to surface ratio) of the feeder must exceed that of the casting. At the same time, the residual amount of metal in the feeder following solidification must be as small as possible, for reasons of cost, and with this aim the walls of the feeder are frequently formed from an exothermal material – for example, an aluminothermic compound. Such a material is ignited by the molten metal, and an exothermal reaction therefore takes place following the penetration of the casting flow into such a feeder, as a result of which heat is fed to the metal in the feeder's internal cavity. Due to the addition of heat, the said metal remains molten longer than the metal in the mould cavity of the casting mould, and is therefore more useful to the feed process.

Many casting moulds are manufactured with the help of a moulding plate which pre-sets the internal contours of the mould cavity. At the points at which a feeder sleeve is required, an individual retaining device is thus frequently provided for – for example, a pin to fix the position of the feeder sleeve.

Following the mounting of the feeder onto the moulding plate (with or without a pin), the moulding material (usually moulding sand, in individual cases also other granular materials) is applied to the moulding plate in such a way that it envelops the feeder sleeve. In a subsequent stage, the moulding material is then compressed, and the feeder is thus enclosed more or less firmly by the compressed moulding material. In this respect, we also speak of moulding pressure.

In an attempt to achieve selective seal feeding, even for relatively small casting areas, the mounting or positioning surfaces of modern feeder sleeves are often laid out to be very small. The feeder sleeve thus tapers considerably in the direction of its positioning surface, and when the moulding material is applied to the moulding plate this frequently results in a problem, in that the moulding material is compressed only to an inadequate extent in the vicinity of the feeder neck, which is a disadvantage in a second cast.

A further problem lies in the fact that exothermal feeders, in particular, but also insulating feeders, can frequently not withstand the crushing forces associated with the process of moulding material compression, and thus break into pieces. Such breaking into pieces then inevitably leads to an uncontrolled feed for the casting.

In spite of this problem, which has been well-known for quite some time, the trend is towards higher and higher compression pressures, which have already compelled the feeder sleeve manufacturers to offer especially stable thick-walled feeder sleeves – which are, however, decidedly expensive, due to the increased demand for material.

For some years, attempts have been made to overcome the problems linked to the increase in the compression pressure by means of so-called spring pins. Spring pins, like fixed (rigid) pins, are intended to retain a feeder sleeve in a pre-selected position. They usually comprise (a) a tubular element for fastening to a moulding plate, (b) a spring mounted in the tubular element, and (c) a pin tip element, which is supported by the spring, and which can be telescoped in or out in the longitudinal direction along the tubular element. Such a spring pin is usually fastened to the moulding plate

(moulding surface), and a feeder sleeve is then positioned on it, the underside of which is positioned, in the initial layout before being filled with moulding material, at a pre-selected distance from the moulding surface. When the moulding material is subsequently poured in, it therefore also runs between the moulding surface and the feeder (underside). And thus, during the subsequent compression (moulding pressure), there is no direct contact between the feeder and the moulding surface, so that the feeder is usually prevented from breaking into pieces, even if a high compression pressure is applied. During the moulding pressure, a force acts on the feeder sleeve positioned on the spring pin in the direction of the moulding plate, which causes the feeder sleeve to be compressed in the direction of the moulding plate against the effect of the spring force. The moulding material layer in the gap between the feeder sleeve and the moulding plate is therefore compressed.

The use of spring pins has certainly contributed to preventing the problems outlined above, but is accompanied, in its turn, by a series of other problems.

Thus the separation of the so-called residual feeder (i.e. the solidified metal remaining in the feeder sleeve after casting) from the casting frequently does not take place at the place where the break should have occurred – i.e. the imaginary interface between the casting and the feeder – but at a considerable distance from the casting, somewhere in the area of the sand gap between the casting and the feeder sleeve, which is frequently several centimetres wide.

It has not so far been possible to make any meaningful use of breaking cores (also described as single-cord, sprueing or rimming cores), which are used elsewhere in foundry practice to bring about a precisely located separation of the residual feeder and the casting, using spring pins. The expenditure on cleaning is therefore usually decidedly high. Moreover, spring pins are decidedly expensive and subject to wear.

In view of the problems outlined above, the first objective of the present invention was to indicate a feeder sleeve which would also withstand high compression pressures when used in the foundry.

It would preferably be possible to give the positioning areas of the feeder sleeve to be indicated here small dimensions without any relevant stability disadvantages.

In addition, it was to be possible to dispense with the use of the spring pins, which are expensive and subject to wear, in normal cases at least.

And finally, it was also intended to be possible to use the feeder sleeve to be indicated in combination with a breaking core, which would simplify the separation of the residual feeder from the casting. A breaking core of this type is thus included as part of the present text, as a constituent part of the feeder sleeve, and not as a separate component.

The problem laid out is solved through the specification for a closed feeder sleeve of the type referred to initially, in which the feeder sleeve comprises at least two mould elements, which can be (telescopically) displaced along a feeder's longitudinal axis inside one another, and which laterally surround the cavity for receiving molten metal. Here a first mould element is mounted nearer to the feeder sleeve passage than an associated second mould element.

The fact that the first and second mould elements can be telescoped in or out ensures that the high compression pressures (crushing forces) in action during a normal compression process in the feeder's longitudinal direction acting on the feeder sleeve according to invention do not break the feeder into pieces, but lead only to a tolerated telescoping of one mould element into the other, limited by the compressability of the surrounding moulding material (moulding sand). Here the positioning surface of the feeder sleeve can be small and the feeder wall comparatively thin.

It should be possible to displace the mould elements telescopically at least 5 mm. from their initial position – i.e. from the relative position which has been specified for the mould elements before the feeder sleeve is surrounded by moulding material - and preferably 10 mm..

Here the feeder sleeve can be designed, in accordance with the requirements of the individual case, for example like a compact or spherical feeder, or can be provided with an almost cylindrical feeder cap in the upper part.

If a feeder sleeve according to invention is used, it will not be advantageous to use a spring pin, except in exceptional cases, for its action, described above, essentially corresponds to that achieved by means of the feeder sleeve according to invention.

The use of spring pins with feeder sleeves according to invention is thus certainly not excluded, but they can usually be dispensed with.

Using a fixed centring pin, on the other hand, makes sense in many cases. One preferred feeder sleeve according to invention is therefore set up for use with a centring pin. It can, in particular, take the form of a self-centring feeder. Such a self-centring feeder has one or more wall sections, which taper in the direction of the cut-off wall of the feeder, which is on top during operation (opposite the feeder passage), in such a way that a pin tip is guided along this section into its intended position while the feeder sleeve is being positioned. In the (upper) part of the wall, which is opposite the sleeve passage`, a centring recess is then often provided to receive the pin tip – cf. our DE registered utility model 93 03 392. A self-centring feeder according to invention is suitable, in particular, for use in rapid forming installations.

The first and second mould elements of a feeder sleeve according to invention can be glued to each other after manufacture or connected in some other way. But the mould elements can also be designed as separate components and combined in accordance with individual requirements (placed on top of each other). First (or second) mould elements of identical construction can thus be combined with second (or first) mould elements of different construction (e.g. as regards their sizes) for individual feeder sleeves according to invention.

Especially preferred are feeder sleeves according to invention in which one or more retaining elements are mounted on the first and / or second mould element

- by means of which the first mould element carries the second mould element (in the initial layout), and
- which are separable or deformable in such a way that the two mould elements can be telescoped along the feeder's longitudinal axis (from the initial layout).

The retaining elements are preferably integral constituent parts of the individual mould elements, and they can be moulded onto the individual mould element during its manufacture, without any additional stage. These can be, in particular, standing or clamped-on projections, continuous upright rings, pins which can be brought into contact with complementary recesses, or the like. It is important in each case here that the retaining elements are laid out in such a way that they can be separated from their associated mould element by means of the subsequent moulding material compression process, or during foundry operation, or at least deformed to such an extent that the first and second mould elements can be telescopically displaced when the first and second mould elements are still in approximately their initial layout, but the moulding material has already been poured into the moulding boxes. The retaining elements here are preferably connected to their associated mould elements only by small connecting areas.

An alternative to the use of retaining elements is the use of a spring pin. More precisely, such a pin can be a second mould element, on top during operation relative to the moulding surface, in the initial position provided for, and to the first mould element, without the feeder sleeve according to invention itself having retaining elements. However, since spring pins, as initially mentioned, are decidedly expensive and subject to wear, their use is restricted to exceptional cases.

The first mould element, nearer to or forming the passage of the feeder sleeve, is preferably formed in such a way that it can be telescoped into the second mould element (following separation or deformation, if applicable). The external dimensions

of the first mould element, underneath during operation and nearer to the casting, are thus preferably smaller than the internal dimensions of the associated second mould element, on top during operation. This initial design is advantageous, by comparison with the reversed initial design (likewise according to invention), in which the mould element on top during operation can be telescoped into the lower mould element, because it ensures that no interfering amounts of moulding material can penetrate into the first mould element during the filling process.

An initial layout is particularly advantageous in which the first mould element, underneath during operation, is formed in such a way that it can be (telescopically) displaced into the second mould element, with the external wall of the first mould element being flush with the internal wall of the second mould element. The gap width between the external wall of the first mould element and the internal wall of the second mould element here preferably amounts to max. 3 mm. – in the initial outlay of the mould elements provided for, which is identified, if applicable, through the position of the retaining elements – and more advantageously to max. 1.5 mm.. With this layout, no relevant amounts of moulding material can penetrate into the gap between the mould elements while the moulding material is being poured in, so that their relative displaceability can not be impaired – at least, not essentially.

It should be possible to telescope the mould elements into each other from their provided initial position – defined by the retaining elements, if applicable – in the feeder's longitudinal direction by at least 5 mm., preferably by at least 10 mm., before any tearing or breaking into pieces of the first or second mould element occurs due to the forces generated between the mould elements when the mould elements are telescoped any further into each other.

It is especially favourable if the first and / or the second mould element has one or more guide elements, which are aligned to prevent any tipping or tilting of the two mould elements relative to each other – in essence, at least – when the latter are telescoped into each other along the feeder's longitudinal axis (starting from the initial layout). These guide elements preferably take the shape of thin strips or bulges

extending in the feeder's longitudinal direction, and they are advantageously located on the external wall of that mould element which can be telescoped into the partner mould element; in a number of cases, they are thus mounted on the external face of the first mould element.

It is more advantageous if a breaking edge is integrated into the first mould element of a feeder sleeve according to invention and if the breaking edge, if applicable, forms a part of a breaking core, which can then be positioned directly onto the moulding plate in operation. In foundry practice, this integration of a breaking edge (a breaking core) makes for a marked reduction in fettling expenditure, by comparison with the known feeder sleeves which are intended for use with spring pins and therefore have no breaking edges (no breaking cores). The setting surfaces of the feeder can be kept very small, in particular, if a breaking edge (a breaking core) is used.

The feeder sleeve according to invention and / or the associated mould elements can be partly or completely manufactured from insulating or exothermal mould elements. If a breaking core is integrated into the first mould element, then this is typically not exothermal, but the associated second mould element will then often be exothermal.

Feeder sleeves according to invention have two or more mould elements which can be stored separately and combined according to demand. The invention therefore also relates to an assembly kit for manufacturing a feeder sleeve according to invention, comprising a first mould element and a second mould element, which can be laid out in such a way that they can be telescoped into each other along a feeder's longitudinal axis. Preferred embodiments of the mould elements belonging to the assembly kit can be derived from the above statements on the feeder sleeve according to invention.

With regard to a wider aspect, the invention relates to a process for mounting a feeder sleeve in a casting mould with the following stages:

- Preparation of a feeder sleeve according to invention in one of its embodiments described above

- Mounting the feeder sleeve in a moulding machine (in the area above a moulding plate, which is normally delimited by a moulding box placed on top) in such a way that the first and the second mould elements correspond to a(n) (initial) layout, from which the two mould elements can be telescoped into each other along a feeder's longitudinal axis

- Pouring moulding material into the moulding machine (the moulding box positioned on the moulding plate) so that the external walls of the feeder sleeve are contacted by the moulding material
- Compressing the moulding material (moulding pressure) so that the first and the second mould elements are telescoped into each other along the feeder's longitudinal axis (if applicable, following the separation or deformation of retaining elements)

The moulding machine thus normally has a moulding plate (i.e. a model device for moulding machines, usually consisting of a flat plate with cast on or mechanically fastened models) and the first mould element is preferably mounted in such a way that before the compression process it is in direct contact with the moulding plate (the model surface). This applies, in particular, when a breaking core is integrated into the first mould element.

With regard to further preferred embodiments of the process according to invention, reference is made to the above clarifications relating to preferred feeder sleeves.

Preferred embodiments of the invention are clarified in greater detail below, with reference to the appended diagrams, which show:

Fig. 1a Longitudinal section through a feeder sleeve according to invention in its initial layout, with two mould elements which can be telescoped into each other, with the feeder sleeve being fastened to a moulding plate by means of a centring pin

Fig. 1b	Longitudinal section through the lower (first) mould element of the feeder sleeve in accordance with Fig. 1a
Fig. 1c	Plan view through the lower (first) mould element of the feeder sleeve in accordance with Fig. 1a
Fig. 2	Longitudinal section through an alternative feeder sleeve with moulded breaking edge
Figs. 3a-d.	Diagrammatic representation of a process according to invention for mounting a feeder sleeve according to invention in a casting mould

The feeder sleeve, 2, according to invention represented in Fig. 1a in its initial layout (before the moulding material is poured in and before the compression process) has a first (lower) mould element, 4, and a second (upper) mould element, 6, with both mould elements taking an essentially rotationally symmetrical shape. The rotation axis of the feeder sleeve, 2, running in the longitudinal direction (feeder longitudinal axis) is identified by a dotted line, 20.

The first mould element, 4, is represented in Fig. 1b again, separately, in a longitudinal section, and is represented in Fig. 1b in plan view. It is moulded from a dry sand (e.g. insulating or exothermal) and is made relatively thin-walled. The positioning surface of the first mould element, 4, with which the latter is positioned on a moulding plate, 22, is small – the positioning surface diameter is only app. 40 mm and the diameter of the feeder lying within the positioning surface is only approximately 20 mm.. Starting from its positioning surface, the first mould element broadens out conically to a maximum diameter of app. 77 mm., and the conical section, 34, defined in this way then goes over into an upper section, 44, which tapers very slightly as it goes up to give a diameter of app. 76 mm..

Already in the area of the upper section, 44, but adjacent to the lower conical section, 34, a total of four retaining projections, 12, is moulded onto the first mould element,

4. The (imaginary) connecting surfaces between the retaining projections, 12, and the mould element, 4, are in each case decidedly small, so that the retaining projections, 12, can be mechanically separated from the mould element with a slight use of force.

Four guide and spacer strips, 14, which are likewise allocated to the retaining projections, 12, extend upwards, starting from the retaining projections in the longitudinal direction of the feeder sleeve, 2, and each project by approximately 2 mm. – as against the external wall of the upper section, 44, of the lower mould element, 4.

Fig. 1a shows the second (upper) mould element, 6, with its lower edge, 26, positioned on the retaining projections, 12, of the lower mould element, 4. It is moulded from an exothermal dry sand and is likewise formed to be very thin-walled. The external contour of the upper mould element, 6, tapers upwards slightly in the direction of an essentially flat upper wall closure, 36, on the external face. Starting from its lower edge, 26, the internal wall of the upper mould element, 4, initially runs parallel to the external wall of the upper section, 44, of the lower mould element, 4, and then goes over into a wall section, 46, tapering upwards, along which the tip of a centring pin can be guided during the positioning of the feeder sleeve. The conical wall section, 46, finally runs into a centring recess, 56, lying in the feeder axis, going through the closure, 36, to receive a pin tip.

The two mould elements, 4, 6, are formed in such a way that the four guide strips, 14, of the lower mould elements, 4, are frictionally engaged with the internal wall of the upper mould element, 6, if the latter, as represented in Fig. 1a, is resting, in the initial layout, on the four retaining projections of the lower mould element, 4. They thus bring about a press fit and prevent any undesirable lateral displacement of the two mould elements. They also define a uniform width for the gap between the lower (here internal) and upper (here external) mould elements.

Finally, Fig. 1a also shows a centring pin which is fastened to the moulding plate, 22, and which extends from there (always lying in the feeder rotation axis, 20) through the feeder passage, 10, and the feeder cavity into the centring recess, 56.

The two mould elements, 4, 6, of the feeder sleeve, 2, can be telescoped into each other if a force (arrow F) directed onto the moulding plate, 22, parallel to the rotation axis, 20, acts on the feeder sleeve, as is the case, for example, when the moulding material has been poured in during the mould pressing (cf. Figs. 3a-d). For this purpose, the force need only be great enough to separate the retaining projections, 12, from the lower mould element, 4.

When pushed onto the first (lower, internal) mould element, the internal wall of the second (upper, external) mould element continuously approaches the latter's external wall, and finally, after a displacement path of app. 15 mm., comes into contact with it all around. A displacement path of this type is sufficient for many compression processes. The final position of the lower edge, 26, of the upper mould element, 6, when the displacement path referred to has been covered is indicated by a dotted line. The guide strips, 14, are deformed or separated when the mould elements, 4, 6, are telescoped into each other, and / or they cut into the internal wall of the external (upper) mould element, 6.

The centring recess, 56, extends through the upper cut-off wall of the feeder sleeve, 2, and the centring pin tip has a cylindrical section, which is markedly longer than 15 mm., and the diameter of which is matched to the internal diameter of the centring recess, 56. For this reason, there is no obstacle when the upper mould element is telescopically pushed onto the lower mould element. Rather does the spindle tip emerge from the feeder sleeve without hindrance.

During a compression process, the lower edge, 26, of the wall of the upper mould element, 6, projecting beyond the lower mould element acts like a stamping surface on the moulding material to be compressed between the edge, 26, and the moulding

plate, 22. The processes (also) taking place during a compression process using the feeder sleeve, 2, are explained in greater detail in relation to Figs. 3a-d.

Fig. 2 shows an alternative feeder sleeve, 202, according to invention, in longitudinal section. It differs from the feeder sleeve, 2, in Figs. 1a-c in that the first (lower) mould element, 204, of the feeder sleeve, 202, has a breaking edge, 214. The feeder sleeve, 202, is also more compact in its form, and its walls are thicker than those of the feeder sleeve, 2. The centring recess, 256, which is present here too, does not go through the upper feeder closure, but extends in the longitudinal direction of the feeder sleeve so far that a co-ordinated centring pin can be pushed sufficiently far into it if the upper mould element, 206, is telescoped onto the lower mould element, 204, in the direction of the moulding plate.

Figs. 3a-d diagrammatically represent a process according to invention for mounting a feeder sleeve according to invention in a casting mould. The clarifications below apply to the feeder sleeve in accordance with Figs. 1a-c, as well as to the feeder sleeve from Fig. 2.

In accordance with Fig. 3a, a first mould element, 104, is positioned onto a centring pin, 116, which is fastened on a moulding plate, 122. The mould element, 104, is thus brought into direct contact with the moulding plate, 122.

Subsequently, in accordance with Fig. 3b, a second mould element, 106, is positioned onto the first mould element, 104, in such a way that it is carried by it. For this purpose, for example, retaining projections, 112, are provided for, which correspond, in their shape and function, to the retaining projections, 12, explained in relation to Figs. 1a-c. We now have an assembled feeder sleeve, 102, in its initial layout – cf. Fig. 1a.

In a subsequent step reflected in Fig. 3c, the feeder sleeve, 102, is enveloped by moulding sand, 150, or by another moulding material (envelope indicated in lower area only).

Following a compression process not represented in greater detail, we obtain the layout in accordance with Fig. 3d. The retaining projections, 112, are broken off by the first mould element, 104. The second (upper) mould element, 106, is telescoped a little further onto the first (lower) mould element, 104. The displacement path, D, of the second mould element, 106, on the mould element, 104, is here pre-selected and delimited by the extent of the moulding material compression.

Since the external wall of the second mould element, 106, projecting beyond the first mould element, 104, acts like a stamp on the air between it and the moulding plate, 122, during the compression process, excellent moulding material compression takes place in this area (indicated in Fig. 3d by a dotted line showing the moulding sand, 150, which is thicker, in comparison with Fig. 3c).

Patent Claims

1. Feeder sleeve for use in the casting of metals in casting moulds, with a cavity for receiving molten metal, characterised in that the feeder sleeve (2, 102, 202) has at least two mould elements (4, 104, 204; 6, 106, 206) which can be telescoped into each other along a feeder's longitudinal axis (20), and which laterally surround the cavity for receiving molten metal.

2. Feeder sleeve as Claim 1, characterised in that on the first mould element (4, 104, 204), nearer to or forming the passage of the feeder sleeve (2, 102, 202), and / or on the second mould element (6, 106, 206) one or more retaining elements (12, 112) are mounted:

- through which the first mould element (4, 104, 204) carries the second mould element (6, 106, 206), and
- which can be separated or deformed in such a way that the two mould elements can be telescoped into each other along the feeder's longitudinal axis (20)

3. Feeder sleeve as Claim 1 or 2, characterised in that the first mould element (4, 104, 204) is formed in such a way that it can be telescoped into the second mould element (6, 106, 206).

4. Feeder sleeve as Claim 3, characterised in that the first mould element (4, 104, 204) is formed in such a way that it can be telescoped into the second mould element (6, 106, 206), with the external wall of the first mould element engaging flush with the internal wall of the second mould element.

5. Feeder sleeve as one of the preceding claims, characterised in that the first and / or the second mould element has one or more guide elements (14), which are aligned in order to avoid, at least in the essential, any tipping or tilting of the two mould elements (4, 104, 204; 6, 106, 206) relative to each other if the latter are telescoped into each other along the feeder's longitudinal axis (20).

6. Feeder sleeve as one of the preceding claims, characterised in that a breaking edge (214) is integrated into the first mould element (4, 104, 204), if applicable as part of a breaking core.

7. Feeder sleeve as one of the preceding claims, characterised in that a guide for a centring pin (16, 116) is integrated into the first and / or second mould element.

8. Assembly kit for the manufacture of a feeder sleeve (2, 102, 202) as one of the preceding claims, having a first mould element (4, 104, 204) and a second mould element (6, 106, 206), which can be mounted in such a way that they can be telescoped into each other along a feeder's longitudinal axis (20).

9. Process for mounting a feeder sleeve in a casting mould, with the following stages:

- Preparation of a feeder sleeve (2, 102, 202) as one of Claims 1-7
- Mounting feeder sleeve in a moulding machine, so that the first and the second mould elements (4, 104, 204; 6, 106, 206) are in a layout from which the two mould elements can be telescoped into each other along a feeder's longitudinal axis (20)
- Pouring of moulding material into the moulding machine, so that the external walls of the feeder sleeve (2, 102, 202) are contacted by the moulding material
- Compression of the moulding sand, so that the first and the second mould element are telescoped into each other along the feeder's longitudinal axis

10. Process as Claim 9, with the moulding machine having a moulding plate (22, 122) and the first mould element (4, 104, 204) being inserted into the moulding machine in such a way that it is in direct contact with the moulding plate.

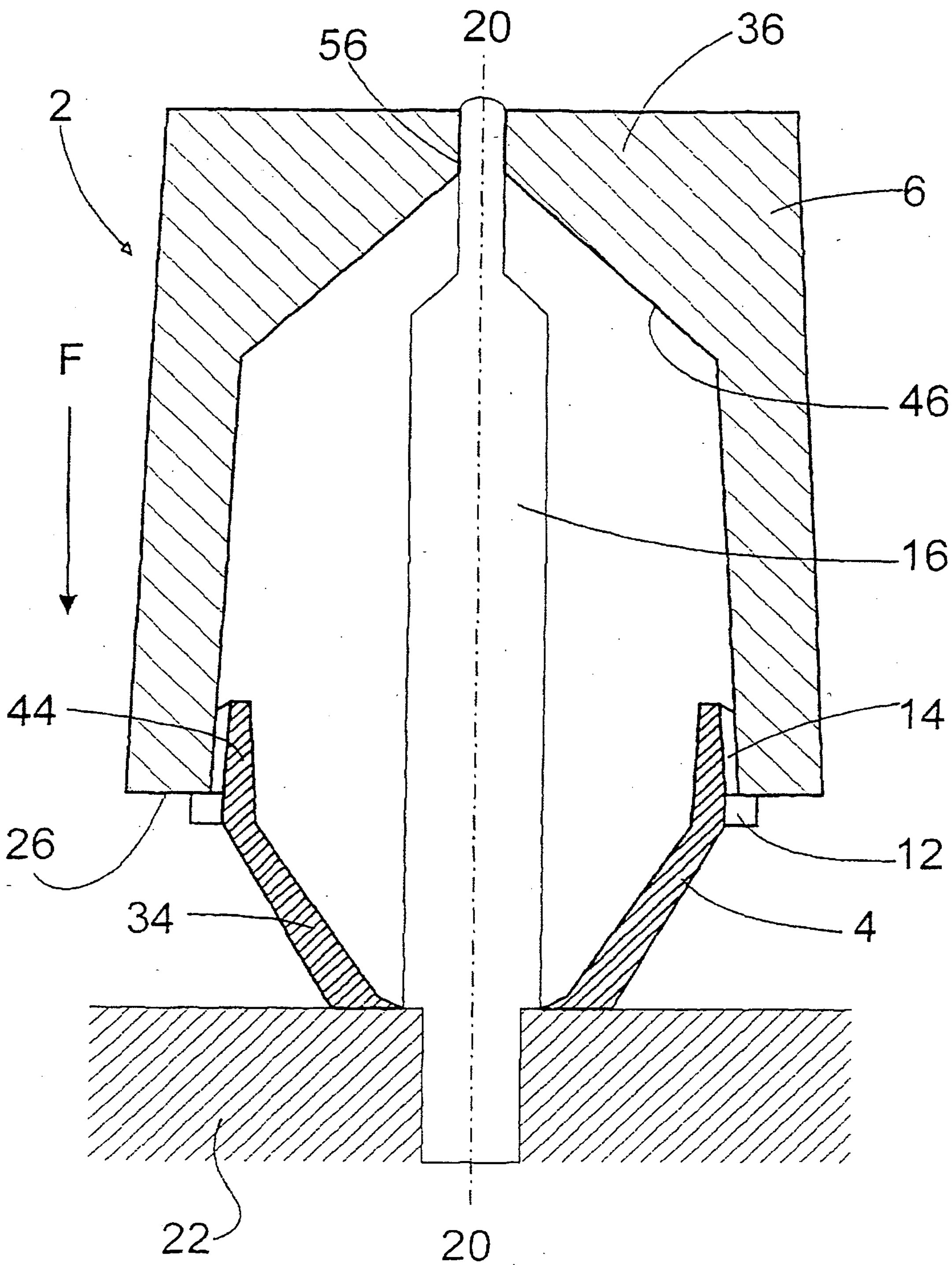

Fig. 1a

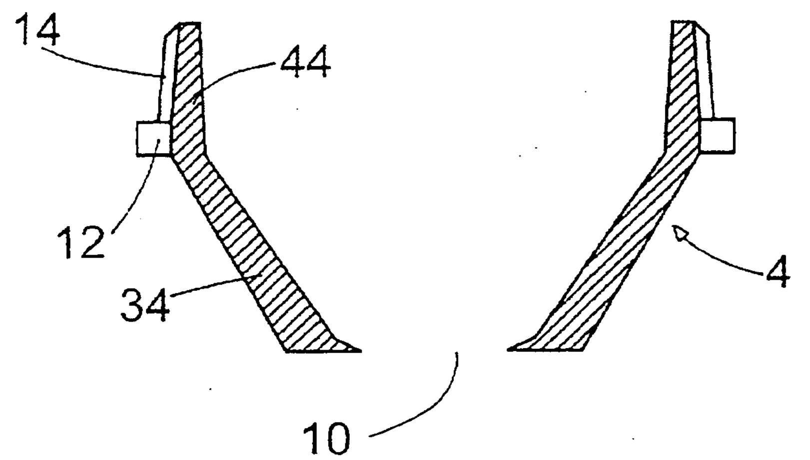

Fig. 1b

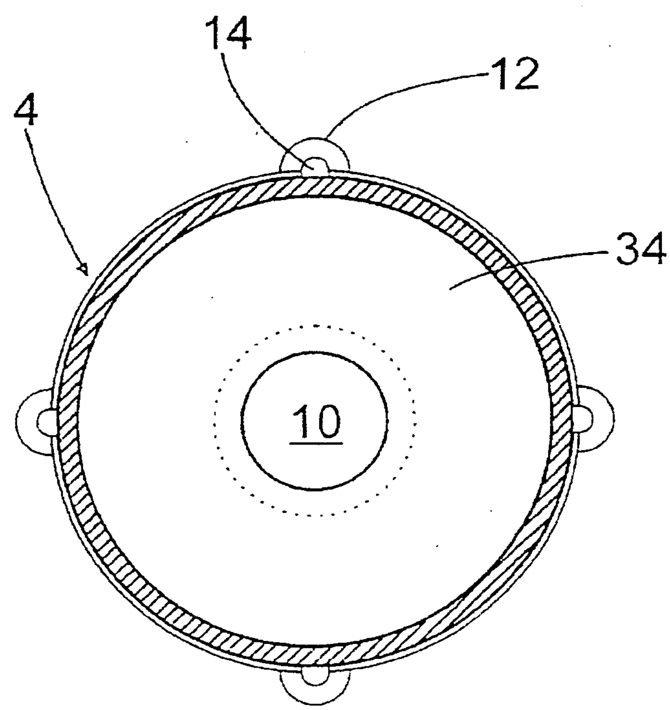

Fig. 1c

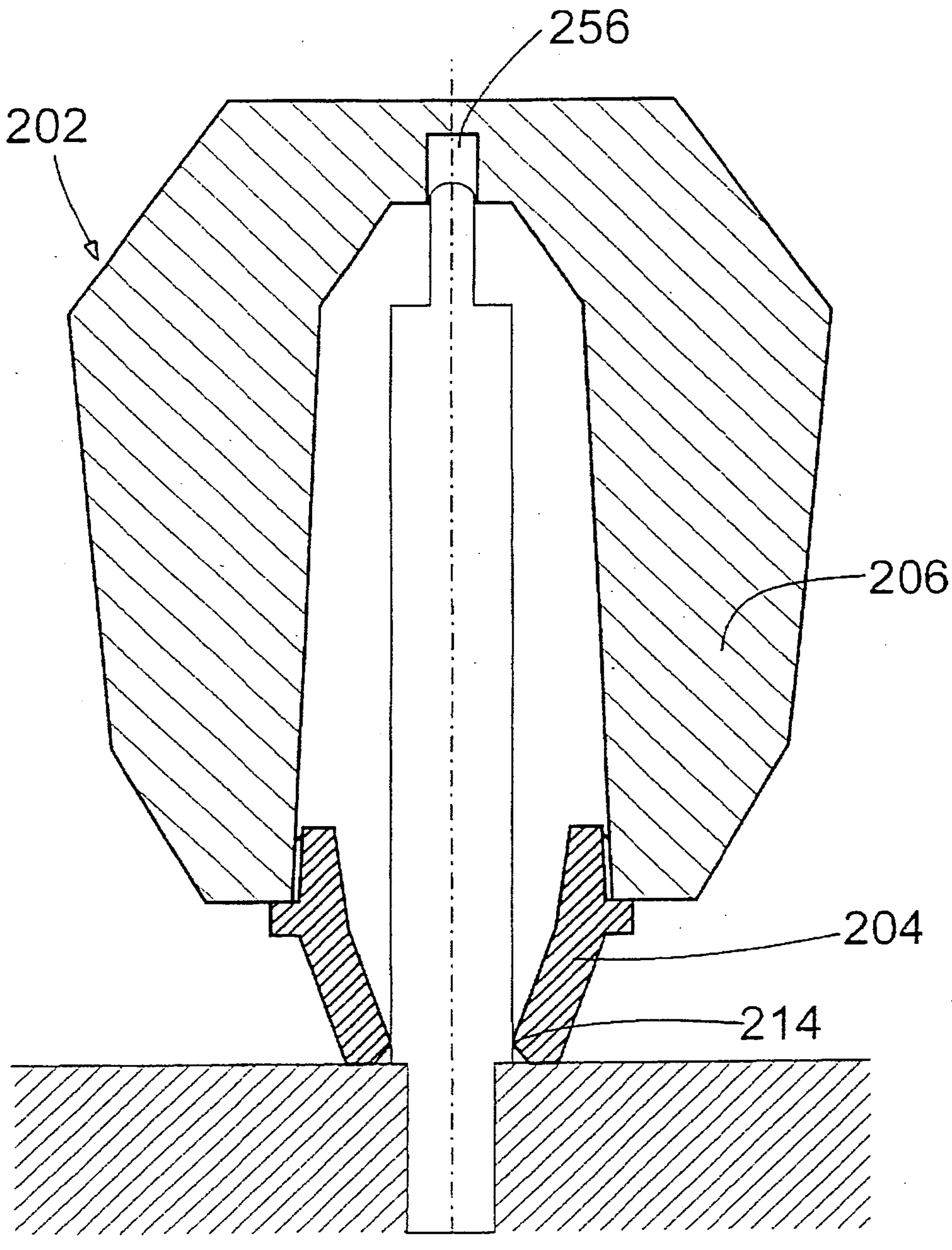

Fig. 2

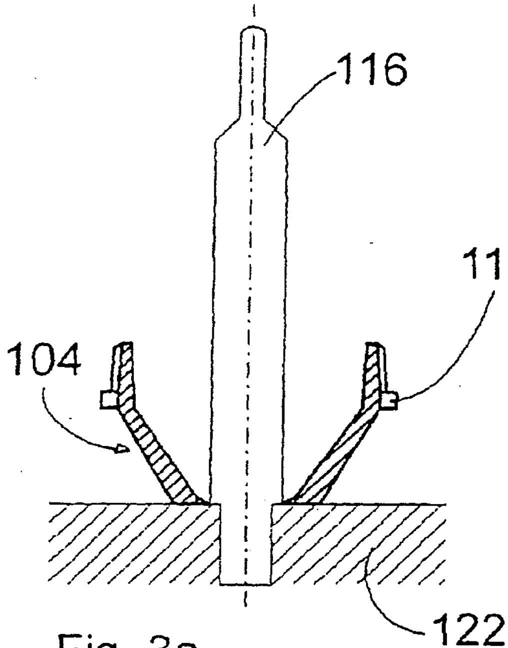

Fig. 3a

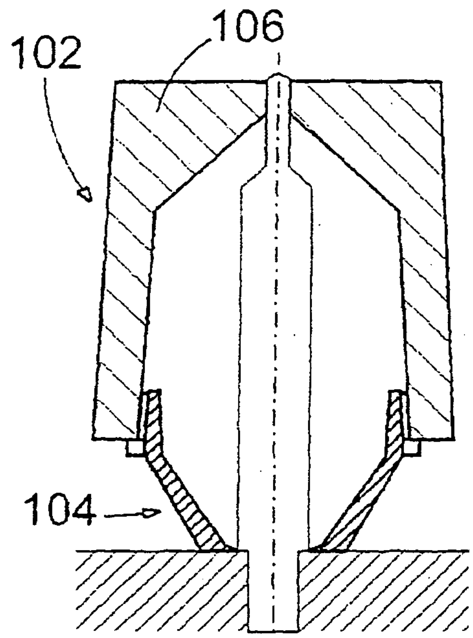

Fig. 3b

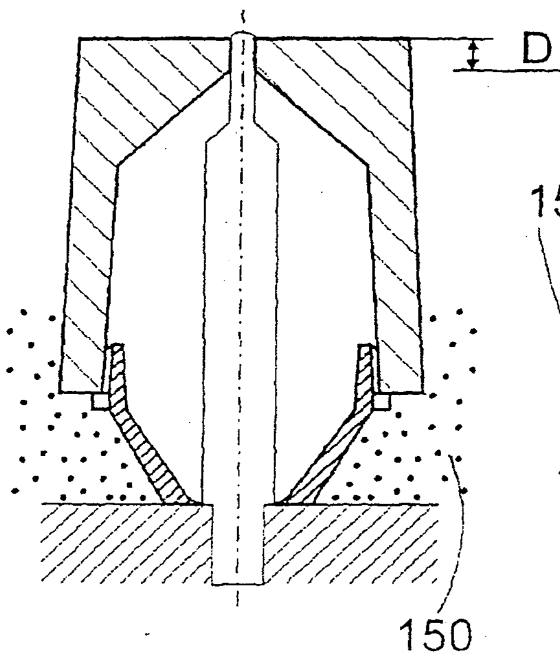

Fig. 3c

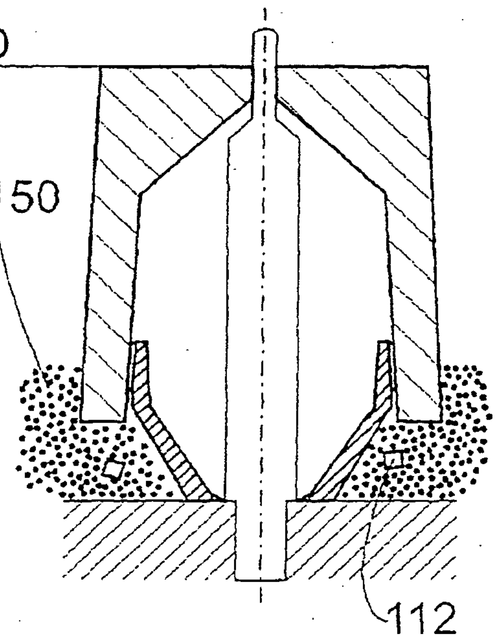

Fig. 3d